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PROGRESS REPORT COVERING THE PERIOD 1 SEPTEMBER, 1972  
TO 31 JANUARY, 1973

URBAN AND REGIONAL PLANNING PROPOSAL NO. Y-10-066-001 SR 196

BREVARD COUNTY PLANNING DEPARTMENT  
TITUSVILLE, FLORIDA

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## DIGITAL ANALYSIS

A program has been completed to print out the radiance values for any specified combination of the four MSS bands for a specified sector of an image. This will be used to supplement visual interpretation, add a quantitative feature to visual interpretation, and provide help in selecting sectors for digital analysis.

A program to map intensities for any band currently is being written.

Programming is being done by Fernando Esparza of Kennedy Space Center. The GE 635 computer at Kennedy Space Center is being utilized.

## CHARACTERISTICS OF CITIES

An investigation of the characteristics of cities in this area, as seen by ERTS, has been started. At this writing, the investigation has not been completed, but results obtained to date will be presented.

Band 5 gives the highest contrast for features on land and has been used for visual interpretation of urban areas; the distinction between urban and non-urban areas usually is quite clear. All of the discussions and drawings to follow refer to observations made on the image of band 5.

It appears to these observers that the ERTS data give the actual urban area as contrasted to city maps and other sources of information which give something other than the actual urban area. In some respects, the small scale imagery has an advantage over relatively large scale aerial photography in

that it avoids the distraction of individual buildings.

### Relative Reflectance

A Digicol viewer was used to determine the relative reflectance of cities (and other developed sectors) in the region. This was done by a combination of two methods:

- (1) varying the Offset control so that the brightest spot appeared first, followed by the second brightest spot, etc.;
- (2) reading the relative light transmissions at selected positions. A band 5 image was used. The results, in order of maximum reflectance apparent within the sector are given in Table 1.

The reflectance figures are relative only, based on a cloud reflectance of 1.00. Within a given scene, for given control settings, and in comparison with the same cloud, reproducibility is within the limits indicated; otherwise, the uncertainty is appreciably greater, so the figures must be considered as approximate only. The value in the MAXIMUM RELATIVE REFLECTANCE column, refers to the brightest spot within the indicated region, and is not a good indicator of the average or total reflectance. The INTEGRATED REFLECTANCE column represents the summation of the products of reflectance times the respective sub-area outlined in the accompanying diagram. This probably is the most significant of the numbers presented in this table and has some significance with respect to effect on the landscape, "hardness" of the region with respect to water runoff, etc. The POPULATION/AREA column represents the

<u>TABLE 1</u>	<u>MAXIMUM</u>		<u>POPULATION</u>	<u>HOUSING UNITS</u>	<u>POPULATION</u>
<u>REGION OR CITY</u>	<u>RELATIVE</u>	<u>INTEGRATED</u>	<u>AREA</u>	<u>AREA</u>	<u>INTEGRATED</u>
	<u>REFLECTANCE</u>	<u>REFLECTANCE</u>	<u>(persons/ha)</u>	<u>(units/ha)</u>	<u>REFLECTANCE</u>
Beach-dune area at New Smyrna Beach	.83				
Patrick Air Force Base	.65				
One sector of Orlando					
Industrial Area, Cape Kennedy Air Force Station	.58				
Port St. John	.58	1076	Area 2: 6.0 Total : 1.2	2.0 .4	1.6
Deltona	.60				
Vehicle Assembly Building, Kennedy Space Center	.54				
Merritt Island	.49	3933	4.0		8.1
Daytona Beach	.49				
Headquarters Area, Kennedy Space Center	.48				
Titusville	.49	1987	6.1		15.4
Cocoa	.48	2090	4.4		12.7
Cocoa Beach	.48				
Sanford					
McCoy Airport, Orlando					
Region south of Patrick Air Force Base	.41				
New Smyrna Beach	.39				
DeLand					
Disney World					

total population of the city divided by the area as outlined from the ERTS image. Preliminary thinking suggests that the POPULATION/INTEGRATED REFLECTANCE figures might be taken as some sort of an indicator of the "quality" of a city, a larger number being indicative of higher quality. Vegetation in a city, for example, will increase this number while exposed buildings, concrete, and asphalt will lower it. Evaluation of the usefulness of this quantity requires further work, but it may turn out to be useful as some sort of an environmental indicator.

The high-reflectance area at New Smyrna Beach is unique in that it is a relatively large barren area (perhaps 300 ha) showing almost entirely sand.

The two sectors of Kennedy Space Center which show up early are characterized by large asphalt parking lots.

#### Port St. John

One of the surprises upon first looking at an ERTS image of the region is finding that this residential development looks like a city, appearing as obvious on the image as, for example, Titusville and Cocoa.

An outline diagram made from a tracing on a transparent overlay is shown in Figure 1. The tracing was made at 2.5X on an Add-Col Viewer and further enlarged in reproduction to give an overall enlargement over the 1/1,000,000 ERTS image of approximately 14X. In the tracing process, boundaries become rounded; in the action ERTS image, they are remarkably straight. In this and the other similar drawings included in this report, it was found most practical to reverse the brightness indication

and give the region with highest reflectivity the darkest shading, leaving blank undeveloped areas and areas not pertinent to the discussion.

In Figure 1, section 1 is a relatively barren area from which much of the vegetation has been removed; the undeveloped rectangular adjacent to it is not part of the St. Johns development area. Section 2 contains all of the houses (570) and people (approximately 1,700). The total developed area (3 + 2) is 1,470 ha, and the area of the inhabited sector (2) is measured as 210 ha, making 2.71 houses/ha. Section 3 has only one building but a completed developed system of asphalt streets, a few sidewalks, and a few cleared lots, the combined effect making it look from above like a city.

Reference to Table 1 shows that Port St. John has a relatively low value of POPULATION/INTEGRATED REFLECTANCE. This follows from the method of development: lots are bought (mostly by people from the Northern sections of the country) for future retirement homes. As the lots are sold, the streets are paved with asphalt, leaving a large area with streets and a relatively small area with houses. A drive through the area shows that some of the streets are beginning to deteriorate.

A reproduction of the corporation's map of Port St. John is included as Figure 2 to show the correspondence between it and the ERTS image.

Relative reflectance by sector for Port St. John is given in Table 2. In this and the similar tables given in this report, the sector numbers correspond to those shown on the diagram for the city.

FIGURE 1

N



US 1

INDIAN  
RIVER

(1)

(2)

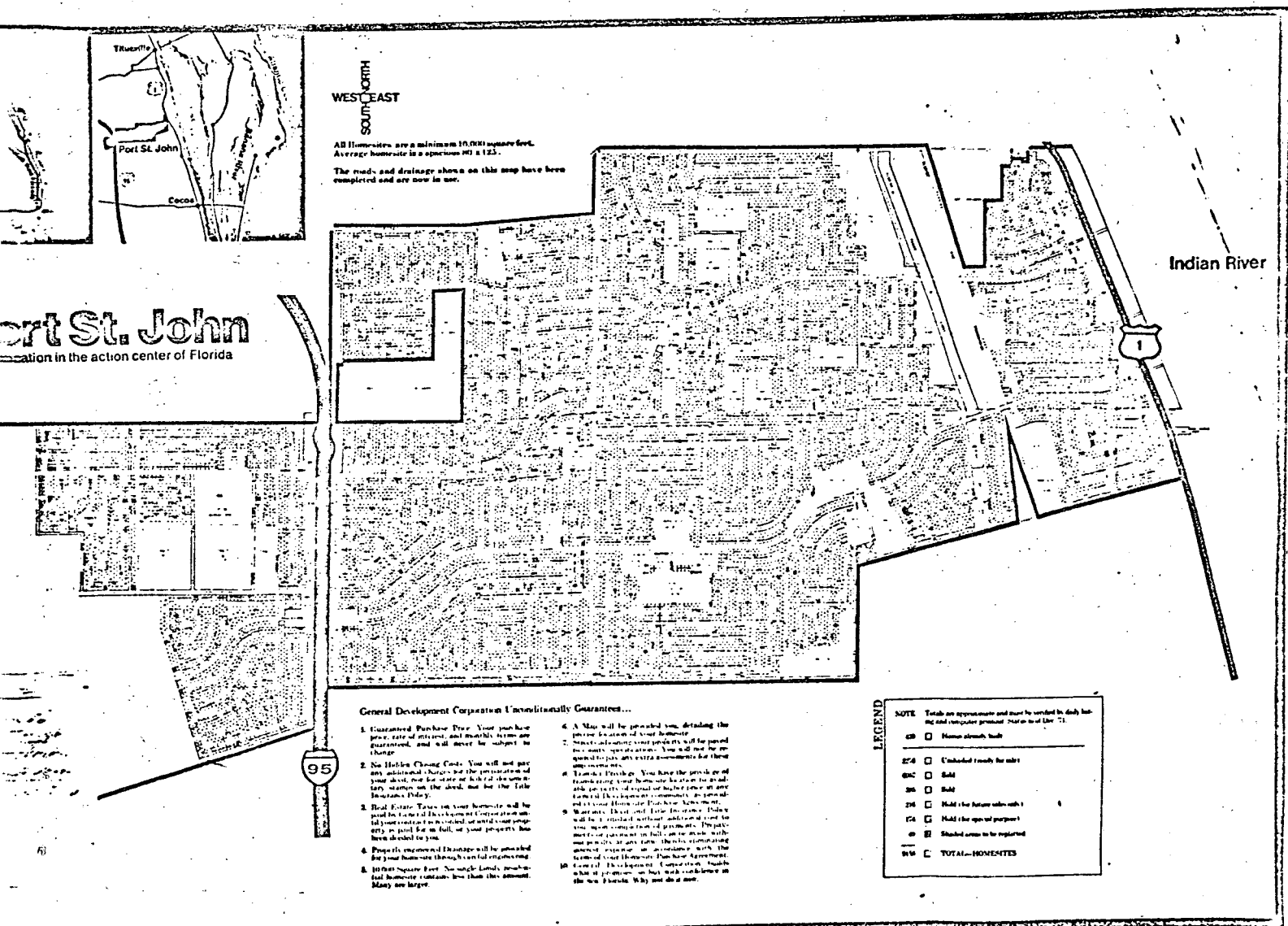
(3)

I 95

PORT ST. JOHN



FIGURE 2



Reproduced from  
best available copy.

TABLE 2      PORT ST. JOHN

<u>Sector</u>	<u>Relative Reflectance</u>
1	.58
2	.42
3	.39

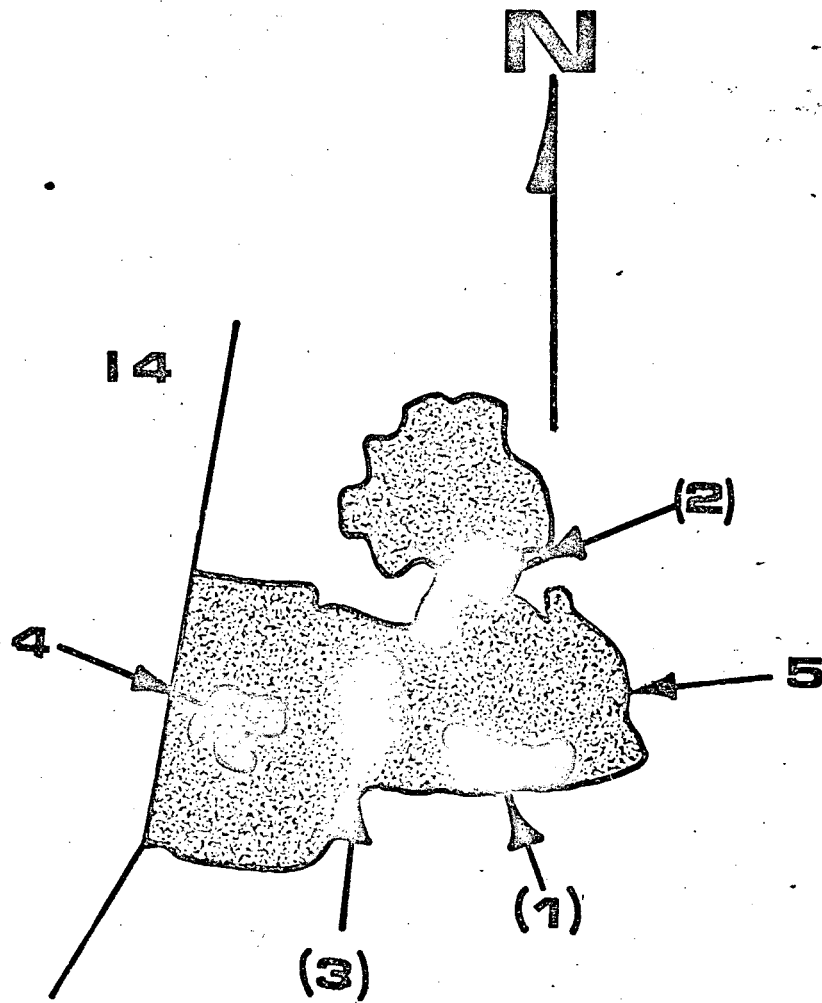
Deltona

This development is similar in nature to Port St. John but is larger and is being developed by a different company. Both of these developments have asphalt roads throughout, have most of the lots already sold (primarily to future retirees) and have houses presently clustered in one or more areas which represent a rather small fraction of the total area. In the case of Deltona, there are three housing areas, labeled 2, 3, and 4, in Figure 3. Area 2, the newest, shows highest reflectivity. Area 1 is an area in which much of the land has been cleared for road construction. Figures 3 and 4 show the ERTS tracing and the company's map respectively, and Table 3 gives the measured relative reflectances of the various regions.

TABLE 3      DELTONA

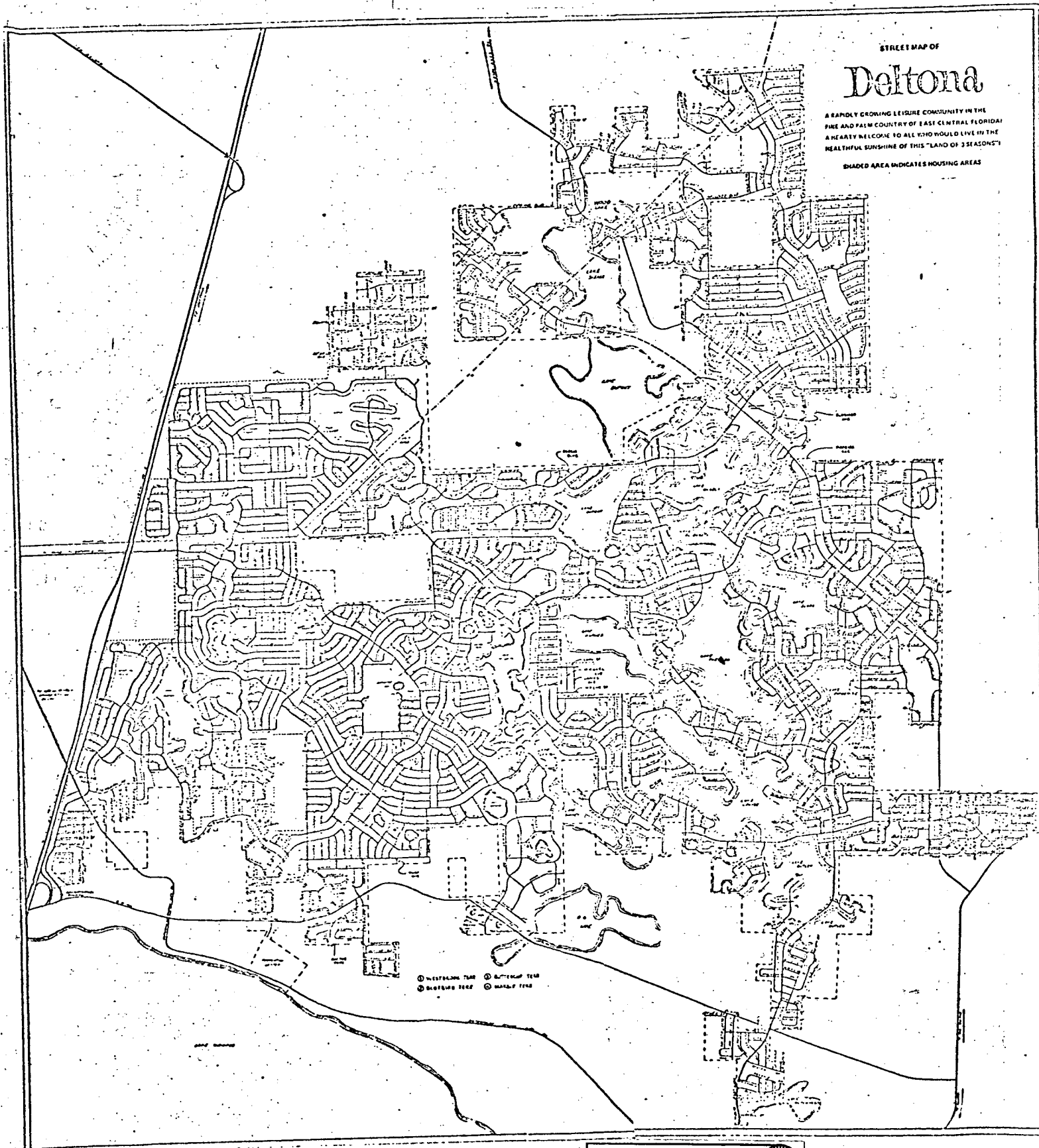
<u>Sector</u>	<u>Relative Reflectance</u>
1	.58
2	.46
3	.45
4	.42
5	.33

FIGURE 3



**DELTONA**

FIGURE 4



### Merritt Island

This is an unincorporated area which has grown rapidly and randomly and presently is under pressure for condominium type growth. Commercial activities are scattered throughout the area shown in Figure 5, with the heaviest concentration along SR-520.

### Daytona Beach

This city shows 4 different degrees of reflectance:

- (1) the beach area, consisting of a wide beach and a high density of resort motels and tourist-oriented businesses,
- (2) a commercial area near the intersection of two interstate highways, (3) the central business district, and
- (4) the remainder of the city:

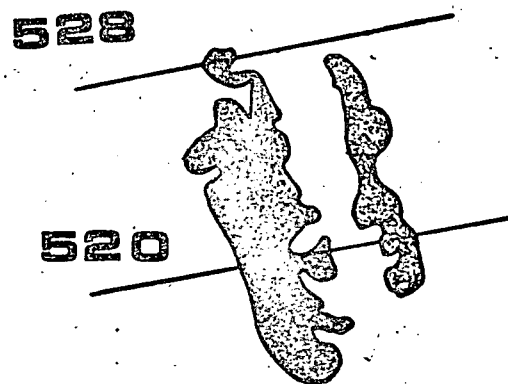
TABLE 4      DAYTONA BEACH

<u>Sector</u>	<u>Relative Reflectance</u>
1	.48
2	.46
3	.44
4	.35

### Titusville

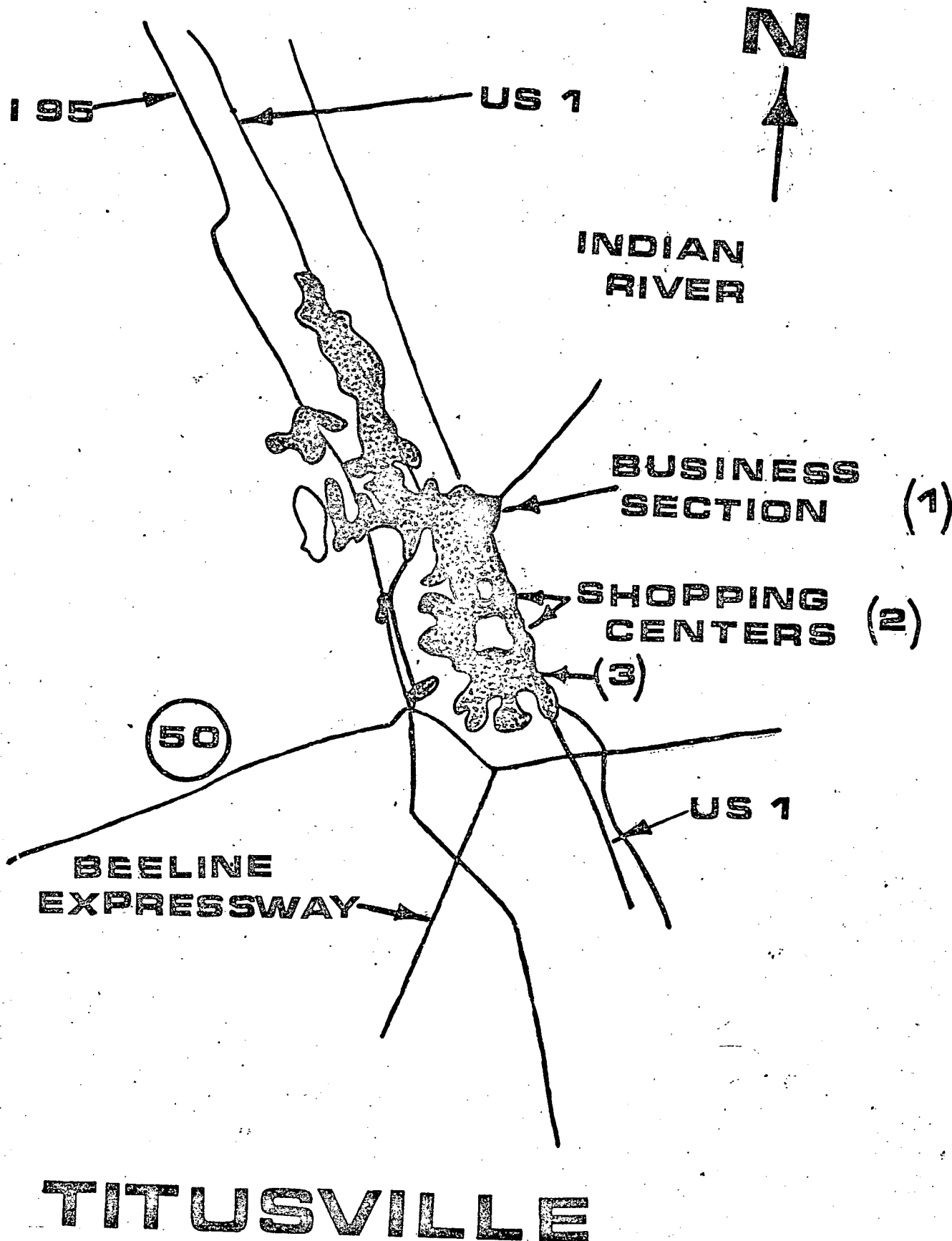
This is the county seat and the city nearest Kennedy Space Center. The developed area is outlined in Figure 6. Development can be seen to extend along two major thoroughfares: U. S. 1 and Garden Street. Three degrees of reflectivity are

FIGURE 5



**MERRITT ISLAND**

FIGURE 6



observed:

- (1) The central business district; highest reflectivity although in an advanced state of deterioration;
- (2) The two major shopping centers in the city are clearly distinguishable; and
- (3) The remainder of the city.

Titusville is unusual in that it has three large (130,150,510 acres - 54,61,206 ha) undeveloped tracts of land in the central part of the city; they are already visible on the image, and the relative reflectance values are given in Table 5.

TABLE 5      TITUSVILLE

<u>Sector</u>	<u>Relative Reflectance</u>
1	.49
2	.41
3	.39

Cocoa

This city shows only two degrees of reflectance: The central business district and the rest of the city. The major dimension of the city is along U. S. 1, with the remainder of the development largely following other arterial thoroughfares. This provides a good example of the influence of the choice of major thoroughfares on the development of a city. The central business district is elongated and narrow, lying principally between U. S. 1 and the Indian River. Two undeveloped areas



(21 and 40 ha) in the central part of the city are clearly visible. They are presently undeveloped because of their marshy nature.

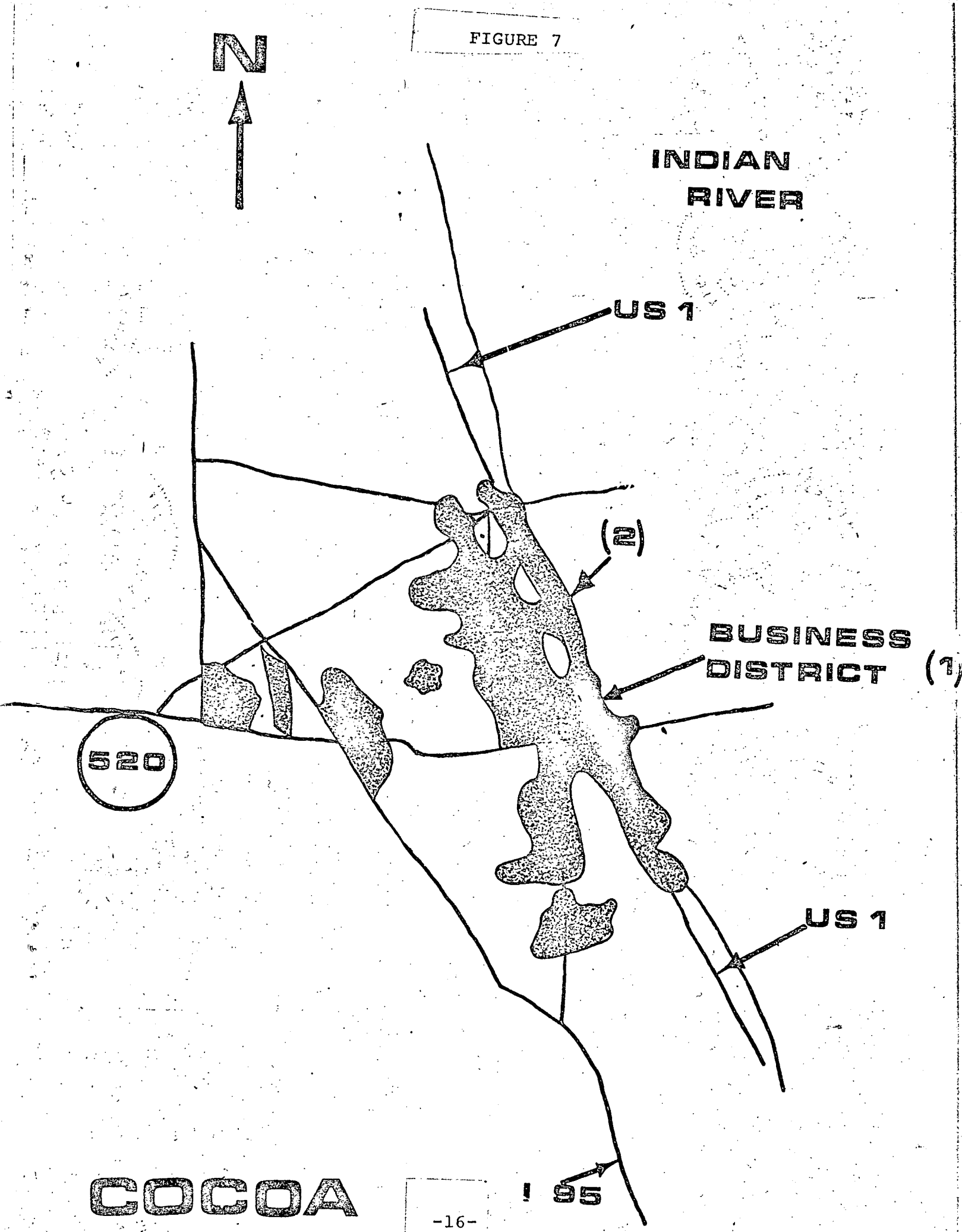
The boundary between Cocoa and Rockledge, a residential suburb of Cocoa, is indistinguishable, so Rockledge is included with Cocoa in Figure 7.

A similarity will be noticed between the development patterns of Titusville and Cocoa. Both have developed along major thoroughfares, a modification of sector development which might appropriately be called "strip development." The particular form of strip development seen in these two cases is characteristic of the cities along U. S. 1; it is influenced strongly by the proximity of U. S. 1 to the Indian River. The same pattern can be seen in Daytona Beach. It can be seen that the development of Daytona Beach, Titusville, and Cocoa is being influenced by the Interstate Highway (I-95). Patches of development are beginning to appear along the interstate. The relative reflectances of the sectors of Cocoa are given in Table 6.

TABLE 6      COCOA

<u>Sector</u>	<u>Relative Reflectance</u>
1	.43
2	.34

FIGURE 7



## VISUAL INTERPRETATION IN GENERAL

Visual interpretation of the images of the four bands has led to some tentative opinions regarding relative utility of the four bands from the standpoint of the purposes of this project:

### Band 4 -

(1) Provides about the same information as that described in items 1 to 9 under band 5, but the contrast is less in band 4.

(2) Water penetration - Serves as rough indicator of lake depths; shallow lakes are clearly distinguishable from deeper lakes. Good indication of bottom pattern off beaches; should be useful in beach erosion studies.

(3) "Wispy" clouds show up on band 4. When looking at other bands (e. g., 6), wispy clouds can lead to errors, which can be prevented by checking against band 4.

### Band 5 -

Gives the greatest contrast for features on land, therefore, appears to be the most useful band for this purpose.

(1) Excellent distinction between urban and non-urban areas.

(2) Major street and development patterns within cities.

(3) Apparent radiance differences between cities, which can be made quantitative by use of digital tape or appropriate viewing equipment.

(4) Good indication of landscape disturbances (e. g., large-scale residential development, truck farming, phosphate mining, canal dredging, new land fill); this is especially true in Florida, where the sand has high reflectance.

(5) Definition of beaches and major highways.

(6) Identification of some farm plots.

(7) Identification of general land use patterns; areas of general agricultural use appear to be delineated.

(8) Identification of heavily vegetated areas.

(9) General matching of patterns with soil maps. The agreement is sometimes striking; at some locations, differences are apparent.

#### Band 6 -

(1) Identification of water surface vs. land.

(2) Drainage patterns.

(3) Delineation of areas of wet soil.

(4) Excellent delineation of rivers.

(5) Good indicator of wetlands (swamps and water within swamp or wetlands; e. g., wetlands along the Gulf Coast).

(6) Some vegetative differences.

#### Band 7 -

(1) Clear definition of water surface.

(2) Drainage patterns.

(3) Moist soil.

(4) Detects map errors with regard to streams, swampy areas, lake shapes.

(5) Clear pattern of individual muck farms bordering Lake Apopka.

Some of the foregoing observations require ground checking and checking with the digital data.

Color Composite

Useful for general viewing of area characteristics, particularly with regard to drainage and vegetation patterns and geologic features.

T/a